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EXAMINER	
JEFFERSON, QUOVAUNDA	
ART UNIT	PAPER NUMBER
2823	

DATE MAILED: 12/05/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/750,021	JUNG ET AL.	
	Examiner	Art Unit	
	Quovaunda Jefferson	2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *30 December 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *various*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Priority

Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Huang et al, US Patent 6,225,187 and Rogers et al, US Patent 4,571,819. See Huang, Figures 2A and 2C and Rogers, Figure 7 below.

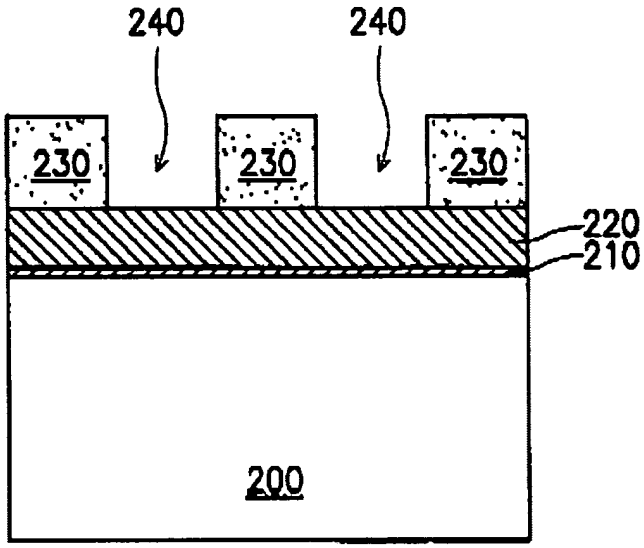


FIG. 2A

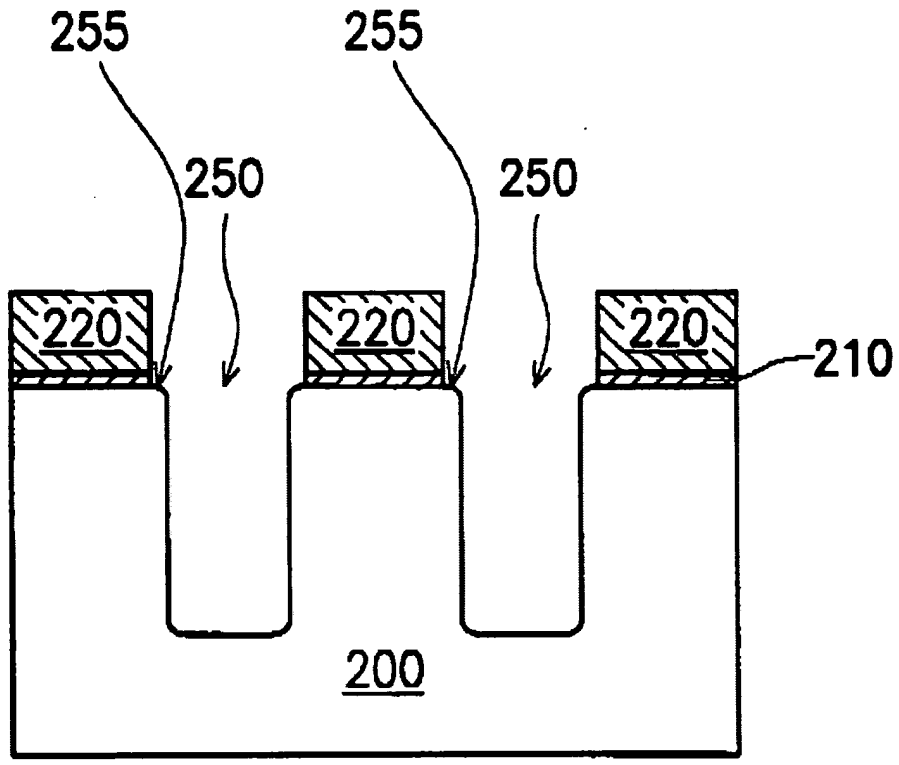
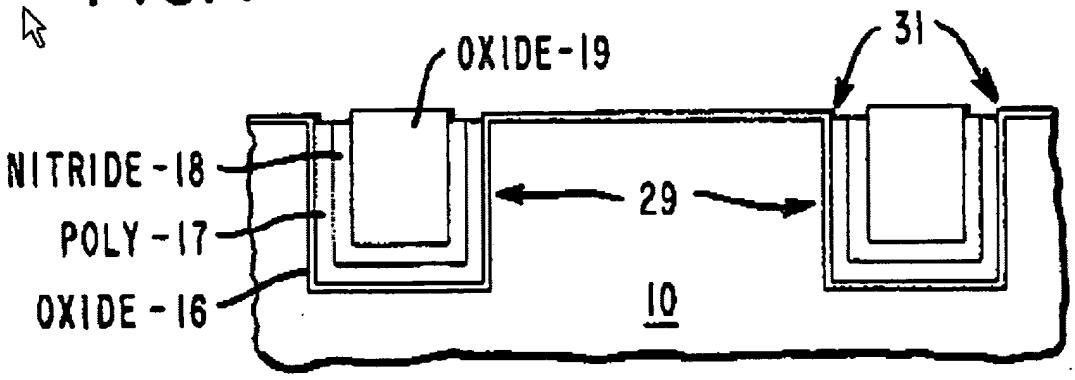

255
255
250
250
220
220
220
210
200

FIG. 2C

FIG. 7


OXIDE-19
31
NITRIDE-18
POLY-17
OXIDE-16
29
10

Huang (Figures 2A and 2C) teaches a method for forming a device isolation layer of a semiconductor device, comprising the steps of forming a pad layer pattern **210&220** defining a device isolation layer on a substrate, forming a trench **250** by etching an exposed portion of the substrate with use of the pad layer pattern **230** as a mask, and performing an etching process to make top corners of the trench rounded **255**. Huang fails to teach forming a lateral oxide layer by oxidating sidewalls of the trench formed after the etching process, forming a liner nitride layer on the lateral oxide layer, forming an insulation layer on the liner nitride layer to fill the trench, and planarizing the insulation layer.

Rogers teaches forming a lateral oxide layer **16** by oxidating sidewalls of the trench formed after the etching process, forming a liner nitride layer **18** on the lateral oxide layer, forming an insulation layer **19** on the liner nitride layer to fill the trench, and planarizing the insulation layer (Figure 7). It would have been obvious to one skilled in this art to combine the teachings of Rogers with that of Huang because this method provides a void-free planar isolation planar isolation layer and a multiple underlayer which functions as an etch stop and dopant/oxidation barrier (Rogers, column 1, lines11-13).

Claims 2-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huang and Rogers as applied to claim 1 above, and further in view of Ibok, US Patent 6,180,466.

Regarding claim 2, Huang further teaches the method as recited in claim 1, wherein the step of forming the trench proceeds by controlling an angle of the top corners of the trench through the use of a gas containing at least hydrogen bromide and chlorine gas (column 2, line 15). Huang fails to teach controlling an angle of the top corners of the trench to be in a range from about 30° to about 60.

Ibok teaches controlling an angle of the top corners of the trench to be in a range from about 30° to about 60° (column 4, lines 35-39). It would have been obvious to one skilled in this art to combine the teachings of Ibok with that of Huang and Rogers because a difficulty with trench isolations with sharp top corners is they induce stress, which is transmitted to the active regions of the substrate, resulting in degradation in the quality of gate oxide and hence, adversely affecting device performance and reliability (Ibok, column 2, lines 8-14).

Regarding claim 3, Huang further teaches the method as recited in claim 2, wherein the step of forming the trench includes the steps of performing an etching process by using hydrogen bromide; removing a native oxide layer formed after the etching process by using carbon tetrafluoride (CF_4) gas, performing an etching process with use of a gas containing hydrogen bromide and chloride gas to form the trench with a predetermined depth, and performing an etching process by using a gas containing

CF_9 and oxygen (O_2) gas to purge the chloride gas from a chamber (column 2, lines 5-22)

Regarding claim 4, Ibok further teaches the method as recited in claim 1, wherein the etching process proceeds by employing an isotropic etching technique (abstract).

Regarding claim 5, Ibok further teaches the method as recited in claim 4, wherein an angle of top corners of the trench ranges from about 50° to about 80° through the use of the isotropic etching technique (column 4, lines 35-39).

Regarding claim 6, Huang further teaches the method as recited in claim 4, wherein the isotropic etching technique uses a gas containing CF_9 and 0_2 gas (column 2, lines 10 and 11).

Regarding claim 7, Ibok further teaches the method as recited in claim 1, wherein the step of forming the lateral oxide layer proceeds by employing a dry oxidation technique (column 2, lines 14-17).

Regarding claim 8, Ibok further teaches the method as recited in claim 7, wherein the dry oxidation technique is performed at a temperature of about 900°C to about 1000°C (column 2, lines 15 and 16). The combination of Huang, Rogers, and Ibok fail to teach forming the lateral oxide layer with a thickness ranging from about 60 A to about

100 A. However, given the teaching of the references, it would have been obvious to determine the optimum thickness, temperature as well as condition of delivery of the layers involved See *In re Aller, Lacey, and Hall* (10 USPQ 23 3-237) "It is not inventive to discover optimum or workable ranges by routine experimentation. Note that the specification contains no disclosure of ether the critical nature of the claimed ranges or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that tile chosen dimensions are critical. *In re Woodruff*, 919 f.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Any differences in the claimed invention and the prior art may be expected to result in some differences in properties. The issue is whether the properties differ to such an extent that the difference is really unexpected. *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Appellants have the burden of explaining the data in any declaration they proffer as evidence of non-obviousness. *Ex parte Ishizaka*, 24 USPQ2d 1621, 1624 (Bd. Pat. App. & Inter. 1992).

An Affidavit or declaration under 37 CFR 1.132 must compare the claimed subject matter with the closest prior art to be effective to rebut a prima facie case of obviousness. *In re Burckel*, 592 F.2d 1175, 201 USPQ 67 (CCPA 1979).

Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Huang et al, US Patent and Chou et al, US Patent 6,110,800. See Huang, Figure 2A and 2C above as well as Chou, Figure 2G and 1D below.

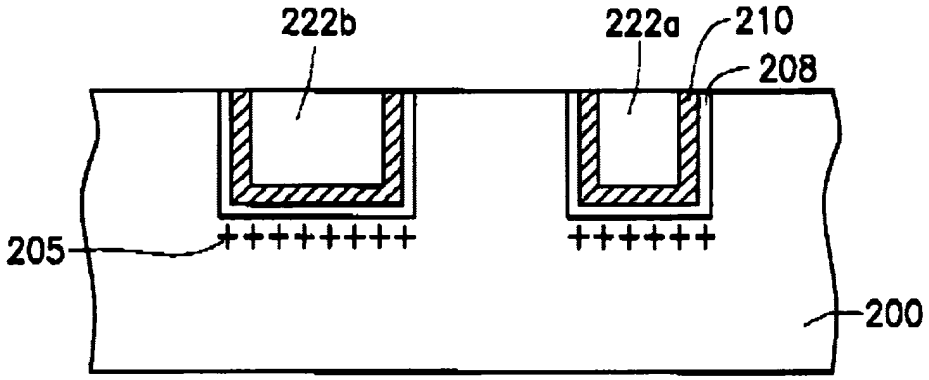


FIG. 2G

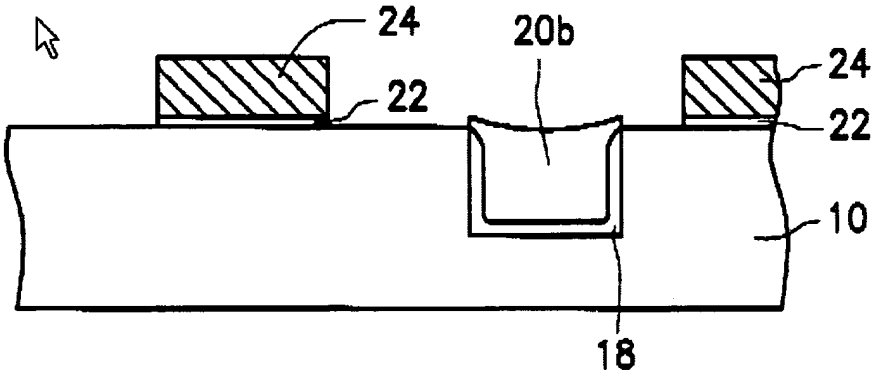


FIG. 1D (PRIOR ART)

Huang teaches a method for fabricating a semiconductor device, comprising the steps of forming a trench **250** of which top corners are rounded **255** by etching a surface of a substrate to a predetermined depth and performing an etching process to the trench so that the top corners of the trench become more rounded. Huang fails to teach forming a lateral oxide layer by oxidating sidewalls of the trench, forming a liner nitride layer on the lateral oxide layer, forming an insulation layer on the liner nitride layer to bury the trench, planarizing the insulation layer until a surface of the substrate is exposed, forming an oxide layer on the exposed surface of the substrate, and forming a conductive layer for a gate electrode on an entire surface of a structure containing the oxide layer.

Chou teaches forming a lateral oxide layer **208** by oxidating sidewalls of the trench, forming a liner nitride layer **210** on the lateral oxide layer, forming an insulation layer **222a** on the liner nitride layer to bury the trench, planarizing the insulation layer until a surface of the substrate is exposed (Figure 2G), forming an oxide layer on the exposed surface of the substrate **22**, and forming a conductive layer for a gate electrode **24** on an entire surface of a structure containing the oxide layer. It would have been obvious to one skilled in this art to combine the teachings of Chou with that of Huang because the purpose of an isolated region in an IC device is to prevent a carrier from drifting between two adjacent device elements to cause a leakage (Chou, column 1, lines 18-21). It would have been obvious to one skilled in this art to combine the teachings of Chou with that of Huang because the purpose of an isolation region in an

IC device is to prevent a carrier from drifting between two adjacent elements to cause a leakage (column 1, lines18-21)

Regarding claim 10, Chou further teaches the method as recited in claim 9, wherein the step of forming the oxide layer includes the steps of forming a screen oxide layer for a threshold voltage control on the substrate, implanting a dopant for a threshold voltage control by using the screen oxide layer as a mask, removing the screen oxide layer, and forming a gate oxide layer on an exposed surface of the substrate after removing the screen oxide layer (column 2, lines 30-37).

Claims 11-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huang and Chou as applied to claim 9 and 10 above, and further in view of Ibok, US Patent 6,180,466.

Regarding claim 11, while Huang and Chou fail to teach the method as recited in claim 9, wherein the lateral oxide layer is formed through a dry oxidation technique, Ibok teaches the method as recited in claim 9, wherein the lateral oxide layer is formed through a dry oxidation technique (column 5, lines 27-29). It would have been obvious to one skilled in this art to combine the teachings of Ibok with that of Huang and Chou because a difficulty with trench isolations with sharp top corners is they induce stress, which is transmitted to the active regions of the substrate, resulting in degradation in the

quality of gate oxide and hence, adversely affecting device performance and reliability (Ibok, column 2, lines 8-14).

Regarding claim 12, Ibok further teaches the method as recited in claim 10, wherein the screen oxide layer and the gate oxide layer are formed through a dry oxidation technique (column 2, lines 14 and 15).

Regarding claim 13, Ibok further teaches the method as recited in claim 11, wherein the lateral oxide layer is formed at a temperature ranging from about 900°C to about 1000°C (column 5, lines 27-29). Huang, Chou and Ibok fail to teach the lateral oxide layer is formed with a thickness in a range from about 60 A to about 100 A. However, given the teaching of the references, it would have been obvious to determine the optimum thickness, temperature as well as condition of delivery of the layers involved See *In re Aller, Lacey, and Hall* (10 USPQ 23 3-237) "It is not inventive to discover optimum or workable ranges by routine experimentation. Note that the specification contains no disclosure of ether the critical nature of the claimed ranges or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that tile chosen dimensions are critical. *In re Woodruff*, 919 f.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Any differences in the claimed invention and the prior art may be expected to result in some differences in properties. The issue is whether the properties differ to such an extent that the difference is really unexpected. *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Appellants have the burden of explaining the data in any declaration they proffer as evidence of non-obviousness. *Ex parte Ishizaka*, 24 USPQ2d 1621, 1624 (Bd. Pat. App. & Inter. 1992).

An Affidavit or declaration under 37 CFR 1.132 must compare the claimed subject matter with the closest prior art to be effective to rebut a prima facie case of obviousness. *In re Burckel*, 592 F.2d 1175, 201 USPQ 67 (CCPA 1979).

Regarding claim 14, Ibok further teaches the method as recited in claim 12, wherein the screen oxide layer is formed at a temperature ranging from about 850°C to about 1000°C (column 2, lines 14 and 15).). Huang, Chou and Ibok fail to teach the lateral oxide layer is formed with a thickness in a range from about 50 A to about 150 A. However, given the teaching of the references, it would have been obvious to determine the optimum thickness, temperature as well as condition of delivery of the layers involved See *In re Aller, Lacey, and Hall* (10 USPQ 23 3-237) "It is not inventive to discover optimum or workable ranges by routine experimentation. Note that the specification contains no disclosure of ether the critical nature of the claimed ranges or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant

must show that tile chosen dimensions are critical. *In re Woodruff*, 919 f.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Any differences in the claimed invention and the prior art may be expected to result in some differences in properties. The issue is whether the properties differ to such an extent that the difference is really unexpected. *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Appellants have the burden of explaining the data in any declaration they proffer as evidence of non-obviousness. *Ex parte Ishizaka*, 24 USPQ2d 1621, 1624 (Bd. Pat. App. & Inter. 1992).

An Affidavit or declaration under 37 CFR 1.132 must compare the claimed subject matter with the closest prior art to be effective to rebut a prima facie case of obviousness. *In re Burckel*, 592 F.2d 1175, 201 USPQ 67 (CCPA 1979).

Regarding claim 15, Ibok further teaches the method as recited in claim 12, wherein the gate oxide layer is formed at a temperature ranging from about 850^0C to about 1000^0C (column 2, lines 14 and 15).

Regarding claim 16, Ibok further teaches the method as recited in claim 9, wherein at the step of forming the trench of which top corners are rounded, the top corners of the trench are rounded in an angle of about 30° to about 60° with use of a gas containing at least hydrogen bromide and chlorine gas (column 2, line 15).

Regarding claim 17, Huang further teaches the method as recited in claim 16, wherein the step of forming the trench further includes the steps of performing an etching process by using hydrogen bromide, removing a native oxide layer formed after the etching process by using CF4 gas, performing an etching process by using a gas containing hydrogen bromide and chlorine gas until the trench has a predetermined depth, and performing an etching process with use of a gas containing CF_4 and O_2 gas to purge chlorine gas from a chamber (column 2, lines 5-22).

Regarding claim 18, Ibok further teaches the method as recited in claim 9, wherein the step of making the top corners of the trench more rounded proceeds by employing an isotropic etching technique (abstract).

Regarding claim 19, Ibok further teaches the method as recited in claim 18, wherein the top corners of the trench is controlled to have an angle ranging from about 50° to about 80° through the use of the isotropic etching technique (column 4, lines 35-39).

Regarding claim 20, Huang further teaches the method as recited in claim 18, wherein the isotropic etching technique proceeds by using a gas containing CF_4 and 0_2 gas (column 2, lines 10 and 11).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Quovaunda Jefferson whose telephone number is 571-272-5051. The examiner can normally be reached on Monday through Friday, 8AM to 4:30PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on 571-272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

qvj

W. DAVID COLEMAN
PRIMARY EXAMINER